

Answer **all three** questions from this section.

Question 7**(55 marks)**

A camogie goalkeeper, on a level pitch, hit a ball straight up into the air.
The path that the ball travelled can be modelled by the function:

$$f(t) = -4t^2 + 16t + 1, \quad t \in \mathbb{R},$$

where t is the time, in seconds, from when the ball is hit and $f(t)$ was the height of the ball, in metres, above the pitch. The ball landed on the ground without being hit again.

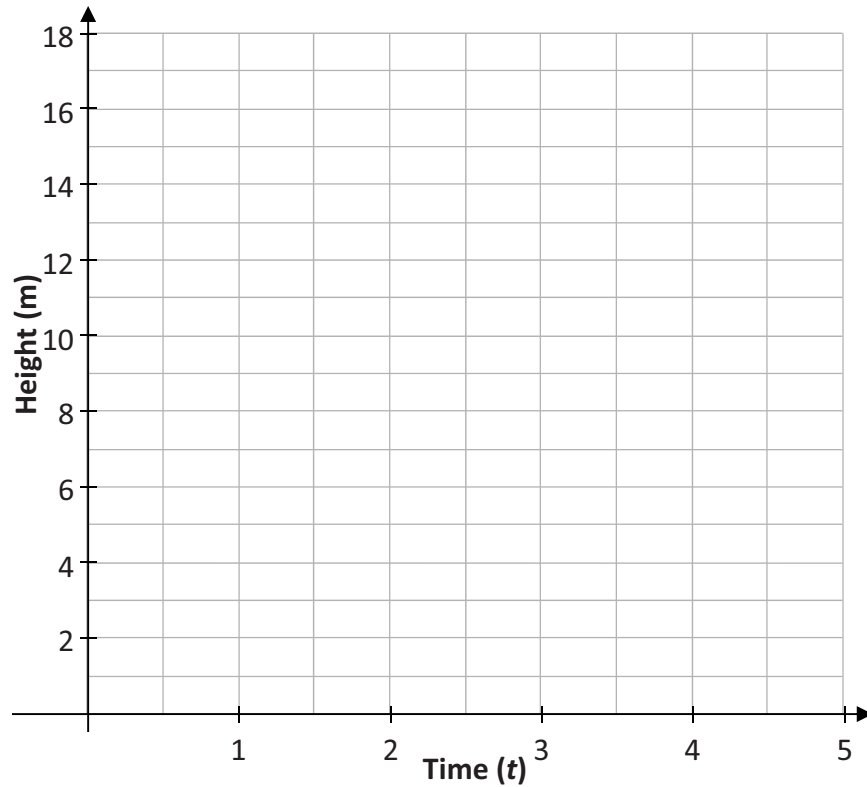
- (a) At what height was the ball when it was hit by the goalkeeper?

- (b) (i) Complete the table below to show the height of the ball at various intervals during the first 4 seconds of its flight.

Time (t)	0	0.5	1	1.5	2	2.5	3	3.5	4
Height (m)						16			

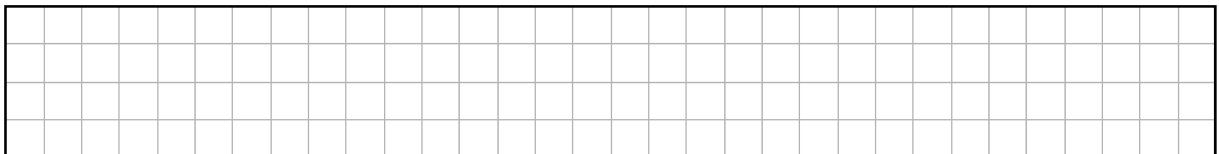


(ii) On the grid below draw a graph to show the height of the ball while it was in the air.

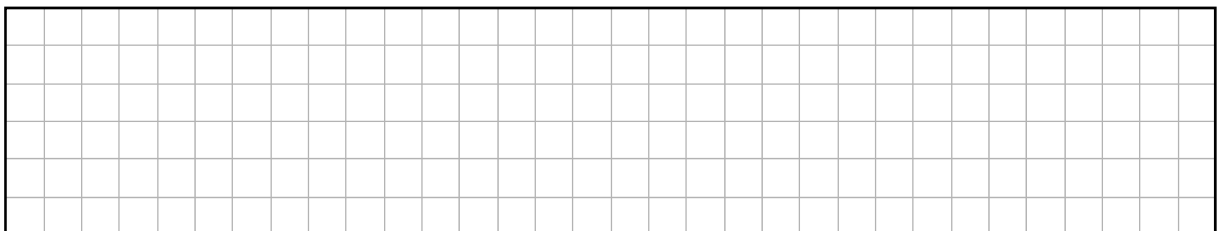


(c) Use your graph to estimate:
(Show your work on the graph above)

(i) the length of time the ball was in the air from the time it was hit until it landed on the ground



(ii) the length of time the ball was 10 m, or more, above the ground.



This question continues on the next page.

- (d) (i) Find $f'(t)$, the derivative of $f(t) = -4t^2 + 16t + 1$.

- (ii) Use your answer from **part (d)(i)** to find the speed of the ball when it had been in the air for 4 seconds. Give your answer in metres per second.

- (iii) Use your answer from **part (d)(i)** to find the value of t for which the ball was descending and travelling at a speed of 8 metres per second.

